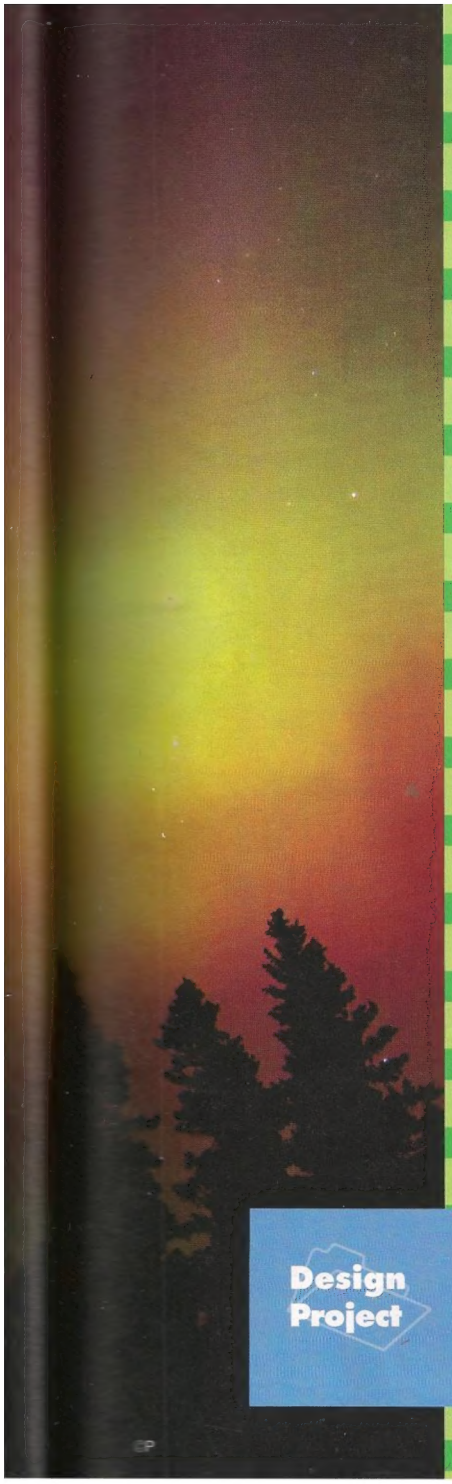
UNIT 3

Magnetism and Static Electricity

BIG IDEAS

In this unit, you will learn that:

- forces make objects move or change
- some forces touch objects, and other forces make no contact at all
- we can use what we know about forces to help us in our daily lives
- forces in nature are important to the ways of First Nations and Métis peoples



Our planet, Earth, is an amazing place to live. Wind, water waves, magnetism, static electricity, and other forces are constantly moving and changing things on Earth.

All around you, you can see forces at work. This photo shows the northern lights that glow when static electricity from the Sun hits air very high in the sky.

In this unit, you will explore how forces act on objects. You will learn about the forces of magnetism and static electricity. You will also learn how we use some forces to do work and make our lives better.

Looking Forward

1. What objects can you see moving and changing around you? In a table, record the objects and the forces that you think are making the objects move and change.
2. What do you want to know about these forces and the forces of magnetism and static electricity? Record questions you want to have answered in the unit.

Design Project

At the end of this unit, you will complete a design project. You will build a toy boat or sled. The *Build On What You Know* activities found in the unit will help you with your project.

Forces Are All Around You

Get Started ▶

Every day, all around you objects are moving, stopping, changing direction, or changing shape. You can see objects move and change, but you cannot always see what makes them move and change. These objects are being acted upon by a force.

There are different types of forces. Some forces, such as a push or a pull, act directly on objects by touching objects. Others act from a distance without touching objects. Look at this picture to see what forces can do and change.

Work On It

1. Look at the picture. Find all the objects that are moving, being stopped, or changing direction or shape. Record them in a list.
2. What do you think is causing each object to move or change? Record your ideas next to each object on your list.

Communicate

1. Compare lists and discuss your ideas with your classmates.
2. As you share ideas with classmates, add any other objects or causes to your lists.

Lesson 1

Contact Forces

Goal To find examples of forces that touch objects

Get Started

Forces help you work and play every day. In science, a **force** is a push or a pull that makes an object move, stop moving, or change direction or shape.

In the pictures shown here, you can see a person pushing a lawn mower and another person pulling a rake. When forces act directly on objects like this, scientists call them **contact forces**.

Work On It

Take a close look at the pictures. What other pushing and pulling forces can you see?

1. Find 10 examples of pushing forces in the pictures. List them.
2. Find 10 examples of pulling forces in the pictures. List them.

Communicate

1. Discuss your answers with your classmates.
2. Why do you think scientists call forces that act directly on objects contact forces? Explain your answer.

Lesson 2

What Is Friction?

Goal To explore the force of friction and its effects

Get Started

You have learned that pushing and pulling are forces that can make objects move, stop, or change direction. When two objects slide over each other, they rub and resist, or try to stop, moving against each other. Scientists call this resistance to movement the force of **friction**.

Friction is a contact force that happens when two objects rub together like this sled and the ground. In which picture do you think there is more friction?

There is friction when a stick is spun on top of a piece of wood. Lots of spinning and friction can give off enough heat and dust to spark a flame. Many First Nations people have started fires this way for thousands of years.

Work On It

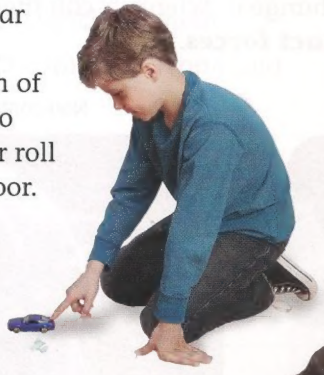
Now you will explore how friction can affect the movement of a toy car.

What You Will Do

1. How do you think friction will affect pushing or pulling a toy car? Write down your prediction.
2. Put the toy car on the floor. Use one push of your finger to make the car roll across the floor.
3. How far did the car roll? Measure and record the distance in a table.
4. Spread out the towel on the floor. Repeat steps 2 and 3, but this time push the car across the towel.
5. Tie the string to the front of the car.

What You Need

- small toy car
- smooth, open floor area
- ruler or tape measure
- towel
- string about 1 m long



6. Pull once on the string to make the car move across the floor. Measure and record the distance the car moves.
7. Repeat step 6, but pull the car across the towel.

Communicate

1. On which surface was it easier to push the car?
2. On which surface was it easier to pull the car?
3. Which surface do you think created more friction? Explain your answer to a partner.
4. How does friction affect how the car moves?

Lesson 3

Can You Move an Object Without Touching It?

Goal To explore forces that do not touch objects

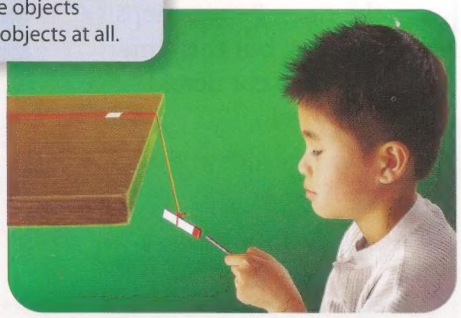
Get Started

You have learned that a force is a push or a pull that acts on an object. You have also learned that a contact force, such as pushing or pulling, acts directly on an object. But not all forces need to contact an object to move or change it. Scientists call these forces **non-contact forces**.

Contact Forces

Non-contact Forces

Some forces move or change objects as they touch the objects. Other forces move or change objects without touching the objects at all.



Work On It

You will explore how different forces can move objects. What two forces are non-contact forces?

What You Will Do

1. Will the force from your fingers, the magnet, the balloon, and the straw move the objects with or without contact? Write down your predictions.
2. Use the force from your fingers to make the objects move. Record your results in a table like the one below.
3. Try to use the magnet to move the objects *without* touching them.
4. Repeat step 3 with the balloon and the straw.

What You Need

- objects, such as a wooden ball, paper clip, your hair
- magnet
- balloon
- drinking straw

Object / Was It Moved by the Force From . . .	Wooden Ball	Paper Clip	Your Hair	Did Anything Touch the Object? If So, What?
Your Fingers				
The Magnet				
The Balloon				
The Straw				

Communicate

1. Which forces moved the objects without touching them?
2. Is blowing air through the straw a non-contact force? Explain your answer to a partner.
3. What did you learn about non-contact forces? In a KWL chart, record what you learned and any new questions you may have.

SAFETY CAUTION!

Never put a magnet in your mouth or swallow a magnet.

Build On What You Know

What forces might you use to move the toy boat or sled that you will build? Write a list of your ideas.

Lesson 4

Exploring with Magnets

Goal To explore what magnets do and their special properties

Get Started

Have you ever found a really special rock? Some people collect rocks that are shiny or smooth or have another characteristic that they like. Many First Nations and Métis peoples understand that rocks and all things found in nature have Spirit and are part of Creator.

Long ago, the ancient Greeks found a very special rock. The name of that rock is magnetite. Magnetite is found in many places around the world. Magnetite may look ordinary, but some of it has one characteristic that makes it special and useful.

▲ The ancient Greeks discovered magnetite near an area called Magnesia. This area is red on the map.

▲ Some magnetite rocks are magnets found in nature.

Today, magnets are very important to us. We use magnets in many objects, such as computer screens, DVD players, and phones. Magnets cause your doorbell to ring and motors to turn. You even use magnets to stick things on your fridge at home. Can you imagine life without magnets?

Work On It

Magnets come in many shapes and sizes. But they all have one thing in common: what they can do. Here is your chance to investigate what magnets can do.

What You Will Do

1. What do you think will happen when you hold a magnet close to each object? Write down your predictions.
2. Explore with a magnet and the objects to find out what magnets can do.
3. Do you think your results would be different if you used a different magnet? Try it.
4. Sort the objects into two groups based on what you found with the magnet.
5. In a table, record the objects in each group.

What You Need

- 2 different magnets
- objects to test with a magnet

SAFETY CAUTION!

Remember to handle sharp objects with care.

Communicate

1. You have observed that magnets have a very special characteristic. Describe this characteristic.
2. What do you notice about all the objects that stuck to the magnets? Explain your answer to a partner.
3. In your KWL chart, add what you have learned about non-contact forces and any new questions.

Lesson 5

Magnets and Poles

Goal To find out if magnets attract other magnets

Get Started

In the last lesson, you saw that magnets pull or **attract** certain objects. Scientists call these objects **magnetic**. Likewise, they call objects that are not attracted to magnets **non-magnetic**.

You have learned that magnets attract some metals, such as iron and nickel. All magnets have two ends called **poles**. Both poles can attract iron and nickel objects. The space around magnets is where magnetic forces act. Scientists call this space the **magnetic field**.

This end is called the south-seeking or **south pole** of the magnet.

This end is called the north-seeking or **north pole** of the magnet.

Can you spot the north and south poles on the short bar magnet, ring magnet, and horseshoe magnet?

Work On It

Do magnets attract each other? In this investigation, you will explore magnets of different shapes and sizes to find out. You will also see what their magnetic fields look like.

What You Need

- pairs of a variety of magnets
- magnetic drawing board

What You Will Do

1. Choose two magnets of the same size and shape.
2. What do you think will happen when the magnets come close together without touching? Write down your prediction.
3. Explore what happens when you place the magnets as shown in the diagrams below.
4. Draw diagrams to record how you place the magnets. Draw arrows to show what happens between the magnets.
5. Put one magnet in the middle of the magnetic drawing board. Draw what you see on the board.
6. Repeat steps 1 to 5 with another pair of magnets.

SAFETY CAUTION!

Do not drop magnets or snap them together. They may chip and small pieces may fly off.

a) N S N S

b) N S S N

c) S N N S

d) N S
N
S

e) N S
S
N

f) N S
N
S

Communicate

1. What happens when a north pole of one magnet comes close to a south pole of another magnet?
2. What happens when like poles of magnets, north and north or south and south, come close?
3. How does a magnet's shape affect how its poles act and the shape it makes on a drawing board?

Lesson 6

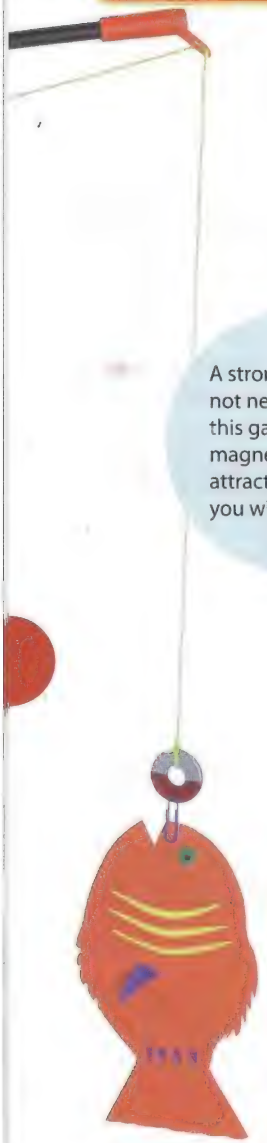
Which Magnet Is Stronger?

Goal To measure the strength of magnets

Get Started

You have learned that magnets attract and push away, or **repel**, some objects and other magnets. But not all magnets attract and repel with the same strength. Some magnets are stronger than others. The size of the magnet does not always tell you how strong it is. Very small magnets can be very strong.

When we use magnets, the size and the strength of the magnets we choose depend on the job we want to do. Look at the photos of magnets at work below.



A strong magnet is not needed to play this game. If the magnet on the pole attracts the right fish, you win a prize!

Why does this magnet need to be very strong?

Work On It

You can measure the strength of magnets by seeing how many magnetic objects of the same size they will attract. Now you will test the strength of two magnets using paper clips.

What You Need

- 2 different magnets
- paper clips the same size
- ruler

What You Will Do

1. Which magnet do you think is stronger? Record your prediction.
2. Touch each magnet to a pile of paper clips.
3. Record your results in a table like the one below.

Distance Above Paper Clips	Number of Paper Clips Picked Up by Magnet 1	Number of Paper Clips Picked Up by Magnet 2
0 cm		
1 cm		
2 cm		

4. Hold a ruler beside the pile of paper clips, as in the photo below.
5. Hold each magnet 1 cm above the pile and repeat step 3.
6. Repeat step 5, but this time hold the magnets 2 cm above the pile.

Communicate

1. Was your prediction correct? Explain your answer.
2. Compare your results with others. Were the stronger magnets always the biggest?
3. How did distance affect the number of paper clips each magnet could pick up?
4. Predict how many paper clips two magnets will pick up together. Check and share your results.

Build On What You Know

How might you use a magnet to move the boat or sled that you will build? Record your ideas.

Lesson 7

Can You Make a Magnet?

Goal To find out if objects can be made into magnets

Get Started

Do you wonder how the rock magnetite became a magnet? Scientists think that magnetite and other rocks that contain iron became magnets by being near a huge magnet for millions of years. This magnet is Earth's core. It is so strong that it has made rocks at Earth's surface into magnets. It has **magnetized** the rocks.

▲ Earth's core is mostly iron and nickel. This makes Earth act like a giant magnet.

How is a magnetized hammer useful? How is a screwdriver with a magnetized end useful?

Magnetic rocks come from Earth, but we can make other magnets. Items that we make into magnets are magnetized. Knowing how to magnetize things can be very helpful.

Work On It

How can you use a magnet to magnetize metal objects? Here is your chance to find out.

What You Need

- iron nail
- magnet
- paper clips
- penny
- nickel
- quarter
- aluminum foil
- pencil
- aluminum pop can tab

What You Will Do

1. Stroke the nail with the magnet by dragging the magnet down the nail. Then lift up the magnet and drag it down the nail again, in the same direction.
2. Test the nail for magnetism after 20 strokes. Try to attract paper clips with the nail.
3. Record your result in a table.

4. Repeat steps 1 to 3 with the penny, nickel, quarter, pencil, aluminum foil, and pop can tab.

SAFETY CAUTION!

Do not put magnets near electronic items, such as computer screens, credit cards, and CD, DVD, and MP3 players. Magnets may damage them permanently.

Communicate

1. Sort your objects into two groups: magnetized objects and non-magnetized objects.
2. Which metal objects did not become magnetized?
3. What do your results tell you about metals and magnetism?
4. Drop your new nail magnet on the floor. Then try to pick up paper clips with it. Is it still magnetized? Explain your answer to a partner.

Lesson

8 Types of Magnets

Goal To find and sort different types of magnets

Get Started

You have learned that Earth has made magnetite and other rocks into magnets. Magnets made by Earth are called **natural magnets**. You have also learned that we can make iron and nickel objects into magnets. But we cannot make copper, aluminum, and other metal objects into magnets.

Magnets that we make can be temporary or permanent. **Temporary magnets,** such as the nail magnet you made in the last lesson, lose their magnetism quickly. **Permanent magnets** stay magnetized for a long time.

Many magnets we use today look nothing like magnetite rock. They are magnets we have made.

Work On It

Think about the magnets you see around you every day. Which type of magnets are they? Look at the picture on the next page. How many magnets can you find in it? List them.

Communicate

1. Compare and discuss your list with classmates.
2. Use a table like the one shown here to sort the magnets on your list.
3. With the class, brainstorm a list of magnets that you might see at school, at home, in a garage, or at a business. Use the table to sort the magnets.
4. With the class, research other examples of magnets used at home, school, or in business. Add them to your list.

Natural Magnets	Temporary Magnets	Permanent Magnets

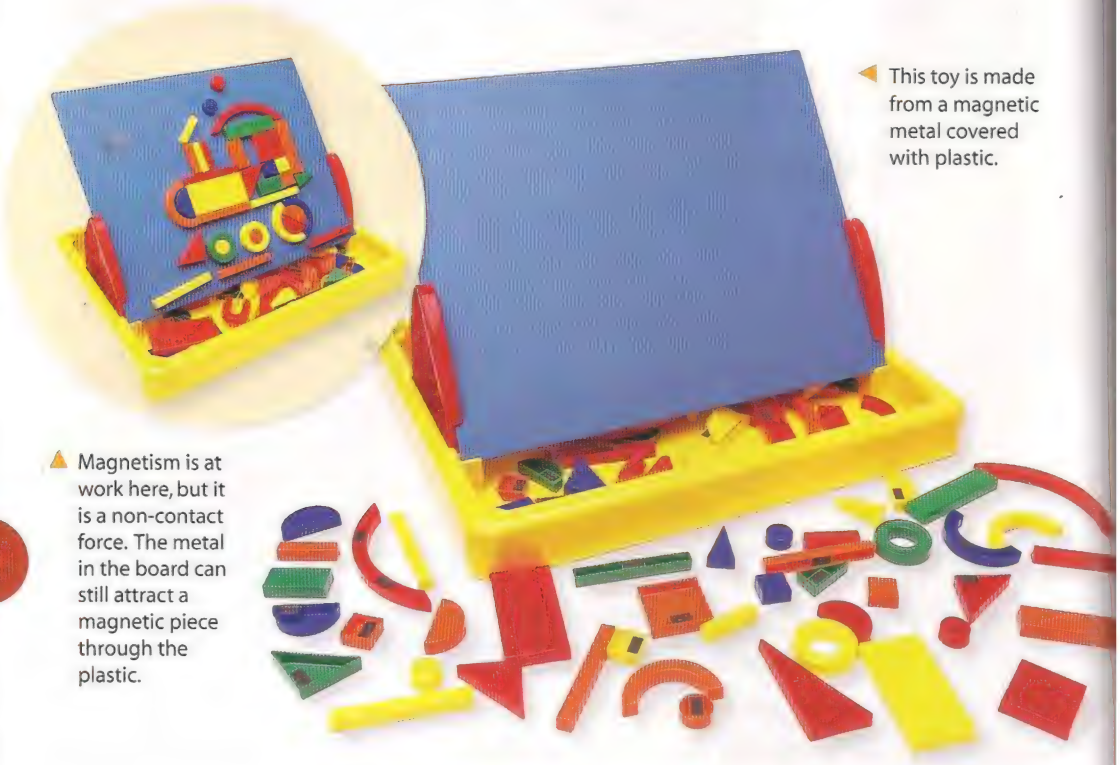
Lesson 9

Do Magnetic Forces Act Through Materials?

Goal To investigate if magnetic forces can act through objects

Get Started

In Lesson 6, you saw the force of a magnet act through air to move paper clips. Do you think a magnet's force can act through plastic, cloth, paper, or other materials the same way?



This toy is made from a magnetic metal covered with plastic.

Magnetism is at work here, but it is a non-contact force. The metal in the board can still attract a magnetic piece through the plastic.

Work On It

What other materials can magnetism act through? Here is your chance to find out.

What You Need

- materials to test, such as cloth, plastic, and cardboard
- 8 books
- paper clip
- wand, horseshoe, or bar magnet
- sheet of paper
- variety of liquid paint colours

What You Will Do

1. Which materials do you think magnetic forces will act through? Write down your predictions.
2. Set up the materials as shown in the photo at the right.
3. Move the magnet under the material to try to make the paper clip move.
4. Record your results in a table.
5. Remove the first material and repeat steps 3 and 4 with the other materials.
6. Place the cardboard between the book piles and put a sheet of paper over it.
7. Put a few drops of paint and the paper clip on the paper. Can you create art without touching the paint?

SAFETY CAUTION!

Do not go under or between the desks or tables. The books could fall if bumped.

Communicate

1. Compare and discuss your results with classmates.
2. How did magnetic forces allow you to make art without touching the paint?
3. In your KWL chart, add what you have learned about magnetic forces and any new questions.

Lesson 10

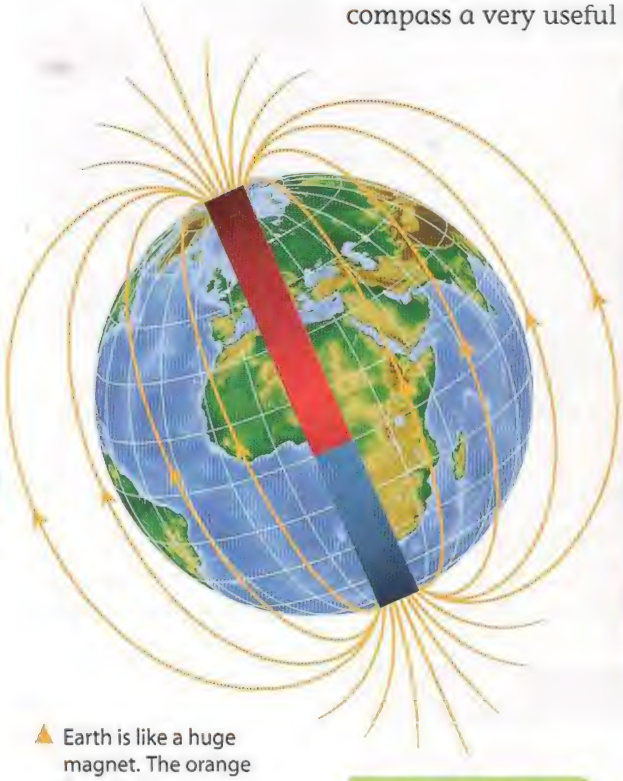
What Can a Compass Tell You?

Goal To explore how a compass can show non-contact forces that you cannot see

Get Started

A compass is another tool that uses a magnet. A compass has a magnetic needle that lets you see where Earth's magnetic field is.

Remember that Earth is like a giant magnet. You cannot see Earth's magnetic poles or magnetic field. But you can see how its magnetic field pulls the needle of a compass to point north. Why does that make a compass a very useful tool?



Earth is like a huge magnet. The orange lines in this picture show what Earth's magnetic field may look like.

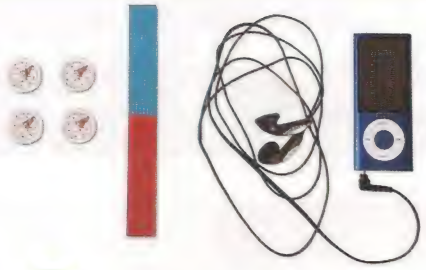
A compass can help you find your way. Its needle points north no matter where you are.

Work On It

In this investigation, you will explore how a compass can reveal magnetic fields.

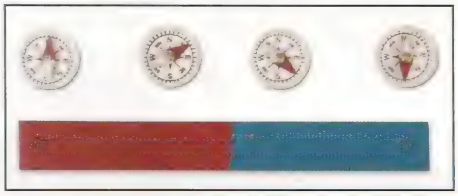
What You Need

- 2 small magnetic compasses for each partner
- large bar magnet to share
- earbuds and music player



What You Will Do

1. What do you think will happen when you put your compasses near the magnet? Write down your prediction.
2. Take turns putting your two compasses near the magnet. Move them to different spots along the magnet. Where do the needles point in each spot?
3. Put four compasses on one side of the magnet, as in the photo.
4. Draw a picture to show how you placed the four compasses along the magnet. Draw an arrow on each compass to show the magnet's field.
5. Put a compass near the earbud wires. Turn on the music player. Record what you see.



SAFETY CAUTION!

Follow your classroom's safety rules. Never touch electrical wall outlets or wires plugged into outlets.

Communicate

1. What happened when you lined up the compasses along the magnet? How is this like magnetic forces acting through different materials?
2. What happened when you put a compass near the earbud wires?
3. How did you know there was a non-contact force near the wires? What do you think it is?

Build On What You Know

Do you think a compass would be useful to add to the boat or sled you will build? Explain your answer.

Lesson
11 What Is Static Electricity?

Goal To find out about the force of static electricity

Get Started

Some First Nations and Métis peoples understand the northern lights as spirits of their people dancing in the sky.

Scientists understand that everything in the universe is made up of tiny particles. They are too small to see with your eyes or even a microscope. Rubbing some materials can cause some of these particles to move from one object to another. So, rubbing your feet on a carpet will cause your socks to pick up some particles from the carpet. Your socks, and even your body, now have extra particles. You and your socks are now **charged** with static electricity. **Static electricity** is the build-up of extra particles.

Now when you touch a doorknob, the extra particles move quickly from you to the doorknob. The rapid movement of these particles gives you the feeling of a shock.

▲ The northern lights are the result of charged particles that travel through space from the Sun.

◀ Static electricity can build up in your hair when you comb it.

▶ Static electricity can build up in a clothes dryer.

Work On It

In this investigation, you will explore the force of static electricity.

What You Will Do

1. What do you think will happen when you put charged balloons near your hair and the other objects? Write down your predictions.
2. With your partner, charge one balloon each by rubbing it quickly with the wool fabric.
3. Hold the balloons close to your partner's hair. Record what happens.
4. Repeat steps 2 and 3 with each of the objects to test.

What You Need

- 2 balloons
- piece of wool fabric
- objects to test, such as tissue and plastic foam bits, classroom walls, curtains, carpets, coats, and plastic and metal items

Communicate

1. Which objects did the charged balloons attract?
2. How did the charged balloons act like magnets? How did they act differently?
3. Fill in the last part of your KWL chart with what you have learned about static electricity.
4. Look at your KWL chart. How are non-contact forces the same as contact forces? How are they different? Discuss your answer.

Lesson

12 Charged Materials

Goal To find out how charged materials interact with each other

Get Started

You have explored how charged materials attract some materials in the same way that magnets attract some metals. Do you think that charged materials will also attract and repel each other? Will they push and pull each other?

This charged metal ball can pull your hair away from your head. Do you think it can attract and repel other charged objects?

Work On It

In this activity, you will find out if charged objects can attract and repel each other.

What You Need

- 2 foam plates
- 2 pieces of string about 10 cm long
- tape
- piece of wool fabric or fur
- sink and water tap

What You Will Do

1. Tape a piece of string to the edge of each plate.
2. Rub the bottom of one plate with the wool fabric or fur.
3. What do you think will happen when you bring this plate close to the plate you did not rub? Write down your prediction.
4. Hold the plates by the strings and slowly bring them close together, as in the photo.
5. Record your observations in a table like the one below.
6. Carry out the other steps listed in the table and record what happens.

What I Did	What Happened
Rubbed one plate and held it near the other plate	
Rubbed both plates and held them close together	
Rubbed one plate and held it near running water	
Rubbed one plate and held it near an object I chose	

Communicate

1. When did the charged plates attract or repel each other and other objects?
2. When you held the charged plates close together, did they act like magnets? Explain your answer.
3. How could you move your body to music or a beat to show how charged objects attract and repel each other? Share your ideas with the class.

Build On What You Know

How could you use the force of static electricity to move your boat or sled? Record your ideas.

Lesson 13

The Strength of Static Electricity

Goal To investigate the strength of static electricity

Get Started

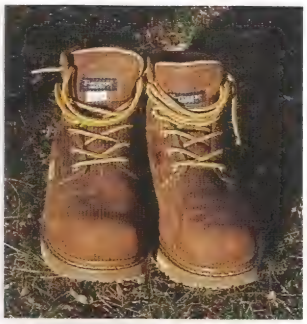
You walk across a carpet in a pair of socks, touch a doorknob, and zap! You get a shock. Most times, the shock results from a small amount of static electricity and is not harmful. But sometimes a discharge, or giving off, of static electricity can be dangerous. For safety, people have found ways to limit the strength of these discharges.

Why might a spark from static electricity be dangerous in these places?

The materials that objects are made of affect the build-up of static electricity. How humid, or damp, air is also affects the build-up of static electricity. Look at the photos below. They show devices that limit the build-up of static electricity.

▲ Static electricity builds up in cool, dry air. A humidifier adds moisture to air to stop this.

▲ Dryer sheets remove static electricity that builds up in clothes dryers.



▲ Some boots and shoes are made of materials that help get rid of static electricity.

Work On It

What affects the strength of static electricity? How long can charges last? Here is your chance to find out.

What You Need

- balloon
- piece of wool fabric
- bare wall
- stopwatch
- spray bottle of water

What You Will Do

1. Rub the balloon with the wool fabric very quickly five times.

2. Push the balloon firmly onto a bare wall.
3. Time how long the balloon stays on the wall before it starts to slip. Record the time in a table.
4. Repeat steps 1 to 3, but do not push the balloon onto the wall. Hold it about 1 cm away, and then let go and see if it is attracted to the wall.
5. Repeat steps 1 to 3, but before you begin timing, ask your teacher to mist some water near the balloon and wall.

Communicate

1. Did distance or water in the air affect how long the balloon stayed on the wall? Discuss your answer.
2. How can you cut down the strength of static electricity? Share your ideas with a partner.
3. In your KWL chart, add what you have learned about static electricity and any new questions.

Lesson

14 Static Electricity and You

Goal To find out about static electricity in nature and how to stay safe when it occurs

Get Started

This pictograph at Reindeer Lake, Saskatchewan, shows Thunderbird.

Lightning flashes when charged particles dart from one cloud to another.

The Keeseekoose First Nation believe that when Thunderbird blinks, lightning flashes from its eyes. When Thunderbird calls, thunder booms in the sky.

Have you ever seen a thunder and lightning storm? The loud booms and bright light are awesome and we respect their power. Some First Nations and Métis peoples understand thunder and lightning as **Thunderbird** [*Piyisew* in Cree], a powerful spirit that brings rain and healing. They let us know the rain is coming.

Today, we can understand lightning as Thunderbird or as static electricity. Charged particles build up in the clouds. When there are too many charged particles, they can move very quickly to a nearby cloud. You see this movement as lightning. They can also move to a tree or building. They move to the tallest object nearby.

Static electricity can travel through some materials and not others. It can travel through metal and water but not rubber. Knowing which materials it can travel through and which materials it cannot travel through can help you stay safe.

Work On It

How can you stay safe around static electricity? Here are some safety rules to follow:

- During a lightning storm, stay inside your house or vehicle.
- If you are indoors, stay away from bathtubs, sinks, electrical appliances, telephones, windows, and doors.
- If you are outdoors, do not take shelter under a tree.
- If you are in the open, go to a low spot and crouch down.
- If you are swimming or boating, go to the shore.
- When refueling a car, do not touch or rub sources of static electricity, such as carpets, seats, or plastic fuel containers.

Look at the picture. Find all the people. Explain the safety rule each person is following or breaking.

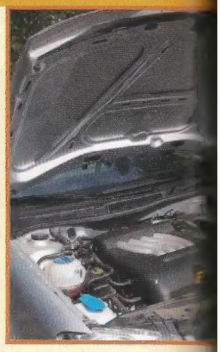
Communicate

1. Which types of materials does static electricity flow through easily?
2. List three things you can do to stay safe in a lightning storm.

Ask. . .

Why is it important to understand forces?

A Mechanic



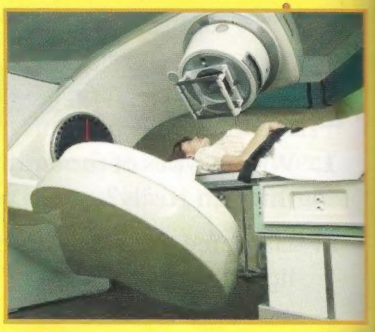
My name is Kelly Henderson. I am a mechanic. Did you know that without magnetic forces your car or truck would not start or move? The windows and doors would not open. The wipers would not turn on, and your heater would not work. Magnets help run small motors in these parts of a vehicle.

In fact, magnetic forces are so important that without them your car's motor would not run at all. A magnet helps make a special charge of electricity. That spark is what makes the fuel start to burn and the motor go! I need to know about magnetism to be able to fix all of these things and keep you safe on the road.

A Doctor

My name is Dr. Lana Silbernagel. I am a doctor. I need to know about magnets to help keep my patients healthy.

When someone is sick, I may need to see inside his or her body. I can use a special machine called an MRI, or magnetic resonance imager. It is not like an X-ray machine, which lets me see just your bones. An MRI machine lets me see inside all the soft parts of your body, such as your heart, your lungs, and even your brain!



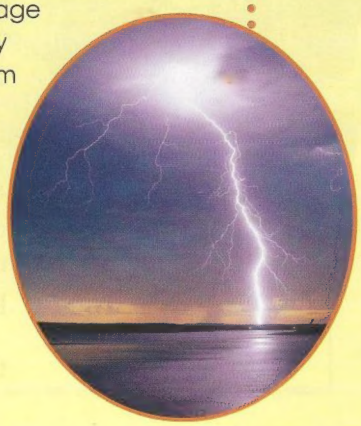
A very strong magnetic field goes around your body. It helps me see the water in cells in every part of you. The MRI lets me see if a part of your body needs my help, without having to do surgery.

An Elder

Tanchika (Hello, how are you?). My name is Betty McKenna. I live in Moose Jaw today, but I was born and raised at Opaswayuk (The Pas), Manitoba. I work in schools as an Elder and am a member of the Anishinabe. Anishinabe means "one of the first people."

Storms make me think about the magnetism of Father Sky and the magnetism of Mother Earth. They want to hold hands. We get lightning strikes because of their strong need to connect. The strong force of that connection makes a loud noise, which is the thunder we hear.

We always knew a storm was coming from the electricity in the air. We were told at a very young age that Thunderbirds were creating static electricity by flapping their wings. Thunder was the sound of them beating their wings together to talk to each other. We also were told that the lightning and thunder beings were attracted to water. When we have a storm, the weather system usually follows a river valley. Storms are the most violent over bodies of water.



Lightning also brings energy to the soil. After a lightning strike, the land has lots of nitrogen, which is good for growing things.

Research

Find out about other jobs related to magnetism or static electricity, such as an office administrator, airport security worker, laundry worker, printer, copier, artist, or painter in a car factory. Find out how magnetism or static electricity is important to them.

Lesson 15

Tricks with Non-contact Forces

Goal To use magnetism and static electricity to create "magic" tricks

Get Started

"Ladies and Gentlemen, welcome to my amazing magic show. I am Ann the Magician!"

Cate stared up at her big sister, Ann, and clapped for the show to start. Today, Ann was pretending to be a magician. She had two magic wands. One wand was dark and the other was clear like glass. Cate tried to peek under the red cloth covering Ann's table.

"Look at me," Ann scolded. "See how I can make this tin toy soldier dance without touching it!"

Ann picked up the dark wand and waved it slowly over the metal toy soldier. The toy soldier started to move around the table.

"Hooray!" said Cate. "Do another trick!"

Ann picked up the clear wand. She rubbed it with a magic cloth and said, "Watch how my paper dolls will dance for you!" Ann slowly waved the wand over some tiny tissue-paper dolls and they began to float up off the table and move around.

"Yay!" shouted Cate. "How did you do that?"

"I am magic!" said Ann.

"You are not magic!" said Cate.

"I'm older than you, so I just know stuff!"

"Just because you're older than me, you're always trying to trick me. But I'll figure out how you did it!"

With that, Cate grabbed the red cloth on Ann's magic table and pulled. Her eyes grew big when she saw that there was nothing under the table but a book about magnetism and static electricity.

Work On It

How did Ann do the magic tricks in the story? Discuss your ideas and try them out.

What You Will Do

1. Reread or retell the story to each other to make sure you understand it.
2. How do you think Ann did each trick? Think about what you have learned about non-contact forces. Write down your ideas.
3. Make a list of the materials you need to test your ideas.
4. Gather the materials and test your ideas.
5. Use magnetism or static electricity to create your own "magic" trick.

Communicate

1. How did Ann attract or repel the toy soldier and the paper dolls?
2. Show a "magic" trick you can do with magnetism or static electricity. Explain how you did it.